REMARKS

This is in response to the *Advisory* Office Action, dated April 11, 2005, where the Examiner has rejected claims 1-70. By the present amendment, applicant has cancelled claims 14 and 48, and has amended claims 1-13, 15-47 and 49-70. Reconsideration and allowance of outstanding claims 1-13, 15-47 and 49-70 in view of the following remarks are requested.

A. Rejections of Claims 1-5, 12-20, 27-34, 42-49, 54-58 and 63-66 under § 103(a)

The Examiner has rejected claims 1-5, 12-20, 27-34, 42-49, 54-58 and 63-66 under 35 USC §103(a) as being unpatentable over U.S. Patent Number 6,453,289 to Ertem, et al. ("Ertem") in view of U.S. Patent Number 5,012,519 to Adlersberg, et al. ("Adlersberg"). For the reasons discussed below, applicant respectfully submits that the present invention, as defined by independent claims 1, 16, 30, 45, 55 and 63, is patentably distinguishable over Ertem in view of Adlersberg.

In response to applicant's explanation to distinguish the pending claims over the cited references, the Examiner has stated that "Further clarification of the independent claims as to what stage the noise is being attenuated would overcome the prior art rejection." To further clarify independent claim 1, applicant has amended claim 1 to recite a speech coding system, where in a first stage and prior to processing of the signal by the encoder, the signal is processed by "a preprocessor configured to receive a digitized signal from an analog-to-digital converter in time-domain, the preprocessor configured to transform the digital signal into frequency-domain, modify spectral magnitudes of the digitized signal in frequency-domain to generate a noise-reduced digitized signal and transform the noise-reduced digitized signal back to time-domain."

In a following stage, the encoder receives the noise-reduced digitized signal in time-domain, and provides a bitstream based upon a speech coding of the noise-reduced digitized signal; "where the speech coding determines at least one gain scaling a portion of the noise-reduced digitized signal; and where the encoder adjusts the at least one gain as a function of noise characteristic for attenuating background noise in at least one frame, wherein the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation." Independent claims 30, 45 and 63 have been amended to include similar limitations as those of claim 1.

Further, independent claim 16 has been amended to recite a speech coding system, where in a first stage and prior to post-processing noise reduction, a decoder receives a bitstream and provides a reconstructed signal based upon a speech decoding of the bitstream; "where the speech decoding determines at least one gain scaling a portion of the reconstructed signal, wherein the decoder adjusts the at least one gain as a function of noise characteristic for attenuating background noise in at least one frame and generating a background noise attenuated signal, and wherein the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation."

In a following stage, the background noise attenuated signal is processed by "a postprocessor configured to receive the background noise attenuated signal in time-domain, the postprocessor configured to transform the background noise attenuated signal into frequency-domain, modify spectral magnitudes of the background noise attenuated signal in frequency-domain to generate a noise-reduced attenuated signal and transform the noise-reduced attenuated

signal back to time-domain." Independent claim 55 has been amended to include similar limitations as those of claim 16.

Applicant respectfully submit that the above amendments clarify claims of the present application as to what stage the noise is being attenuated and, therefore, pending claims of the present application, as amended, overcome the cited references at least for the following reasons.

Embodiments according to the present invention relate to digital speech coding systems having noise suppression capabilities. Conventional frequency-domain noise suppression techniques reduce some background noise in speech frames. However, the conventional frequency-domain techniques introduce significant speech distortion if the background noise is excessively suppressed. The frequency-domain noise suppression techniques may produce a relatively unnatural sound overall, especially when the background noise is excessively suppressed.

Embodiments according to the present invention relate to a noise suppression system and method that accurately reduces the background noise in a speech coding system. Advantageously, the present system utilizes a gain factor Gf to suppress the background noise in the time domain while maintaining the speech signal. For example, independent claim 1 recites "adjusting at least one gain as a function of noise characteristic for attenuating background noise in at least one frame, wherein the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation".

In contrast, Ertem utilizes a voice activity detector (VAD) that employs line spectral frequencies and enhanced input speech which has undergone noise reduction to generate a voice activity flag. A gain function is smoothed both across frequency and time in an adaptive manner

based on an estimate of the signal-to-noise (SNR) ratio. As stated in Ertem and shown in FIG. 7 of Ertem, the input speech signals goes through the FFT process (see block 90), and then in block 98 and in the frequency domain, "gain functions are computed ... using the smoothed noise spectral estimate and the input signal spectrum ...." (Col. 11, lines 58-61.) Thereafter, in block 104, an inverse FFT is applied to the frequency domain sequence to obtain the time domain signal. (Col. 12, lines 9-13.)

Therefore, Ertem does not disclose, teach, or even suggest that the gain factor is adjusted in the time domain; rather, Ertem discloses that gain functions are computed using the smoothed noise spectral estimate and the input signal spectrum in the frequency domain. In contrast, claim 1 recites "wherein the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation."

Furthermore, the new cited referenced Adlersberg suffers from a similar shortcoming. For example, FIG. 4 of Adlersberg clearly shows that the functions of subblocks 19, 52, 53, 58, 55, 56 and 59 are performed in the frequency domain after applying FFT 40 to the speech signal, and before applying IFFT 70 to convert the frequency domain signal to the time domain signal. Therefore, Adlersberg teaches that any gain adjustment is performed in the frequency domain and not the time domain. In contrast, as stated above, claim 1 recites "wherein the at least one gain is adjusted according to a gain factor, the gain factor facilitating time-domain background noise attenuation."

For the foregoing reasons, applicant respectfully submits that the present invention as defined by independent claims 1, 16, 30, 45, 55 and 63 is not taught, disclosed, or suggested by Ertem and Adlersberg. Thus, independent claims 1, 16, 30, 45, 55 and 63 are patentably

distinguishable over Ertem and Adlersberg. As such, the claims depending from independent claims 1, 16, 30, 45, 55 and 63 are, *a fortiori*, also patentably distinguishable over Ertem in view of Adlersberg for at least the reasons presented above and also for additional limitations contained in each dependent claim.

B. Rejections of Claims 6-11, 21-26, 35-41, 50-53, 59-62, and 67-70 under 35 USC §103(a)

The Examiner has rejected claims 6-11, 21-26, 35-41, 50-53, 59-62, and 67-70 under 35 USC §103(a) as being unpatentable over the combination of Ertem in view of Adlersberg in further view of U.S. Patent Number 6,161,090 to Chandran, et al. ("Chandran"). Applicant respectfully submits that claims 6-11, 21-26, 35-41, 50-53, 59-62, and 67-70 depend from independent claims 1, 16, 30, 45, 55, and 63, respectively, and thus, claims 6-11, 21-26, 35-41, 50-53, 59-62, and 67-70 should be allowed at least for the same reasons discussed above in conjunction with patentability of independent claims 1, 16, 30, 45, 55, and 63.

C. **Conclusion**

For all the foregoing reasons, an early Notice of Allowance directed to all claims 1-13, 15-47 and 49-70 pending in the present application is respectfully requested.

Respectfully Submitted,
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